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10/718,524	11/24/2003	David James Wilson	ALC 3098	1982

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EXAMINER	
EBIRIM, EMEKA	

ART UNIT	PAPER NUMBER
2166	

DATE MAILED: 07/18/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/718,524	WILSON, DAVID JAMES	
	Examiner	Art Unit	
	Emeka Ebirim	2166	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11/24/2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *11/24/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Status

1. Claims 1 – 26 are pending in this Office action.

The application has been examined. Claims 1-26 are rejected as detailed below and are pending in this office action.

Claim Objections

2. Claim 1 is objected to because of the following informality: The claim recites, "bits of at said" in element d of claim 1. The meaning of this is not clear. For the purpose of this office action, Examiner will interprete it as "bits of said". Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-6, 10-20 and 24-25 are rejected under 35 U.S.C. 102(e) as being anticipated by Pub No: 2004/0085953 to Davis (hereinafter Davis).

Claim 1.

Davis discloses:

A method of forwarding protocol data units PDU's in a router with a forwarding hash table, comprising the steps of [Forwarding table, Para 0003, 0017,0035, Fig 1-2]:

a) selecting a window size of n window bits and an offset of o offset bits (predetermined number ("N") or the most significant bits (window size)) [fill bits (offsets) See Davis Para 0017 & 0021-0022, Fig 2];

b) generating a grouping table with sets of prefix lengths based on said window size and offset [length table, prefix length, hash buckets (group), See Davis Para 0017-0018, 0226 Fig 2, Fig 2,4-5];

c) using said n window bits as a direct index into said grouping table to find an initial prefix length and provide an associated entry into said hash table ("N" is used to index into the table) [index, keys, prefix length, hash table, See Davis Para 0017-0018, Fig 2-5]; and

d) performing a lookup in said hash table based on said initial prefix length for matching said window bits with the bits of at said associated entry (search hash table (lookup))[keys (associated entry) See Davis Para 0016-0017 Fig 2-5].

Claim 2.

Davis discloses the elements of claim 1 as above and furthermore it discloses:

e) generating one of a hit pointer and a miss pointer in response to said lookup and loading said hit and miss pointers into a binary search tree (produces a hash value for indexing (pointer); matches (hits)) [See Davis, Para 0026-0027, Fig 2-5]; and

f) determining a next prefix length for a respective miss pointer and hit pointer [prefix length, next key, match (hit), See Davis, Para 0026-0027, Fig 2-5]; and

g) performing a further lookup in said hash table based on said next prefix length for matching said window bits with the bits of a further associated entry in said hash table [prefix length, next key, match, hash table, search, See Davis, Para 0026-0027, Fig 2-5].

Claim 3.

Davis discloses the elements of claim 2 as above and furthermore it discloses repeating steps e), f) and g) until a longest matching prefix is obtained [longest prefix match, See Davis Para 0016 & 0033].

Claim 4.

Davis discloses the elements of claim 2 as above and furthermore it discloses forwarding said PDU along a route identified by an IP address in said hash table corresponding to said longest matching prefix (forwarding the internet protocol) [hash table, longest matching prefix, IP address, routing information, See Davis Para 0016 & 0026].

Claim 5.

Davis discloses the elements of claim 1 as above and furthermore it discloses selecting said offset such that the maximum number of prefix lengths per set is a

minimum [See Davis Para 0020 & 0021].

Claim 6.

Davis discloses the elements of claim 1 as above and furthermore it discloses selecting said offset such that the average number of prefix lengths per set is minimized [See Davis Para 0020 & 0021].

Claim 10.

Davis discloses the elements of claim 1 as above and furthermore it discloses hash table is updated when said window is updated [hash table, updates, See Davis Para 0040].

Claim 11.

Davis discloses the elements of claim 1 as above and furthermore it discloses window is a uni-dimensional window comprising a predetermined number of consecutive bits (predetermined number of bits) [See Davis Para 0017].

Claim 12.

Davis discloses the elements of claim 1 as above and furthermore it discloses window is a multi-dimensional window comprising a predetermined number of groups of consecutive bits [Fig 3B Para 0028].

Claim 13.

Davis discloses the elements of claim 1 as above and furthermore it discloses wherein the number of bits of said window is selected for enabling said grouping table to fit into a fast memory [hash table, memory structure (fast memory), See Davis, Fig 3B Para 0031-0032].

Claim 14.

Davis discloses the elements of claim 1 as above and furthermore it discloses wherein the window size, n, is user-selectable [See Davis Para 0017].

Claim 15.

Davis discloses the elements of claim 1 as above and furthermore it discloses wherein step a) comprises selecting said offset using said binary tree [binary tree, See Davis Para 0006, 0028, Fig 3A-B].

Claim 16.

Davis discloses the elements of claim 1 as above and furthermore it discloses wherein said binary tree is made up of a root tree generated by said offset bits, partial trees within said window generated by said window bits, and sub-trees subtended by said partial trees [binary tree, root node, See Davis Para 0006, 0028, Fig 3A-B].

Claim 17.

Davis discloses the elements of claim 16 as above and furthermore it discloses wherein the number of prefix lengths searched for said window and said offset is a set union of the prefix lengths in said root tree, the prefix lengths of the sub-trees grouped by said window bits, and the extended prefix lengths occurring within the window grouped by said window bits [binary tree, root node, intermediate node, See Davis Para 0006, 0028, 0031, Fig 3A-B].

Claim 18.

Davis discloses the elements of claim 16 as above and furthermore it discloses, wherein said set union is obtained by iterating over all nodes of the tree within said window (values corresponding to one of the keys produced from the prefix tree) [binary tree, root node, See Davis Para 0006, 0028, 0031, Fig 3A-B].

Claim 19.

Davis discloses the elements of claim 16 as above and furthermore it discloses, wherein said n and o are chosen periodically on a best effort basis [See Davis Para 0016].

Claim 20.

Davis discloses the elements of claim 1 as above and furthermore it discloses, wherein said n and o are chosen at router startup, and updated as a low priority background application [Background operation, See Davis Para 0020, 0040 Fig 5].

Claim 24.

Davis discloses:

A memory for storing data for access by a routing program being executed on a router having a hash table, comprising [router, hash table, See Davis Para 0035] :

a prefix length array for storing a grouping table comprising 2.sup.n entries, each entry corresponding to a prefix length available for matching n bits of the IP address of a protocol data unit (PDU) (number of entries is a power of two) [See Davis Para 0036]; and

a search area for storing a prefix length search tree constructed using said grouping table based on a lockup in said hash table, said lookup being performed for a prefix length in said grouping table, using said n bits in said IP address [store, table, prefix tree, hash table, See Davis Para 0040].

Claim 25.

Davis discloses the elements of claim 24 as above and furthermore it discloses wherein n is selected small enough so that said grouping table fits into a fast memory [hash table, memory structure (fast memory), See Davis, Fig 3B Para 0031-0032].

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 21-23 are rejected under 35 U.S.C. 102(b) as being anticipated by "Forwarding Engine For Fast Routing Lookups And Updates" to Daxiao Yu et al (hereinafter Yu).

Claim 21.

Yu discloses:

A method of forwarding a protocol data unit (PDU) at a router with a forwarding hash table, comprising the steps of [routing protocol, routing table, forwarding table, See Yu, Section 3]:

dividing the prefix lengths available in said hash table into groups (group of route prefixes of lengths) [memory module (groups), See Yu section 8 Para 3 (or page 1563 Para 2), Table 1]; and

routing said PDU according to a lookup in said hash table based on the prefix lengths in a selected group of said groups [route, prefixes, hash, memory modules (group), lookup operations, See Yu Section 5.2.2, Section 6 Para 1].

Claim 22.

Yu discloses the elements of claim 21 as above and furthermore it discloses

wherein said step of dividing comprises selecting a set of n bits from the IP address of said PDU and arranging said selected group in the form of a grouping table with all prefix lengths available for said n bits [memory module (group)See Yu, Section 5.2.2 Para 2-3, Table 1].

Claim 23.

Yu discloses the elements of claim 22 as above and furthermore it discloses, wherein said step of routing comprises:

using said n bits for finding an initial prefix length in said grouping table, to determine an associated entry into said hash table (hash index consists of prefix's bits and each hash index references a table) [Prefix length, table, hash, See Yu section 5.1 Para 2-4]; and

performing a lookup in said hash table based on said initial prefix length for matching said window bits with the bits of at said associated entry [table lookup, See Yu section 6 Para 4-5].

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 7-9 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Davis in view of "Forwarding Engine For Fast Routing Lookups And Updates" to Daxiao Yu et al (hereinafter Yu).

Claim 7.

Davis discloses the elements of claim 1 as above but does not explicitly indicate "dynamically tuning the order of prefix lengths searched in said grouping table using statistical data collected at said router", Yu discloses the claimed limitation (allocates routes prefixes based on statistics from the routing table [Yu section 5.2.2, Table 1].

It would have been obvious to one of ordinary skill in the art to have combined the cited references because such statistical data usage would enable Davis to spread out route prefixes evenly and thus reduce the overall number of hash collisions [See Yu section 5.2.2, Para 3].

Claim 8.

Yu discloses the element of claim 7 as above and furthermore it discloses wherein said statistical data indicate the hits for each prefix length in each set [hit, See Yu Section 6 Para 6].

Claim 9.

Yu discloses the element of claim 7 as above and furthermore it discloses lookup is dynamically tuned to process the prefix lengths in the order from the prefix lengths with a greater percentage of hits (lookup starts with the most likely prefix length) [Hit, See Yu, section 6 Para 1, Para 6].

Claim 26.

Davis discloses the elements of claim 24 as above but it does not explicitly indicate "wherein said prefix length search tree is constructed based on dynamic flow measurements to favour prefix lengths which are used by the majority of the PDUs at said router". Yu discloses the claimed element (levels of tree generating forwarding table; allocating route prefixes based on specific statistics) [See Yu Section 8 Para 2-3].

It would have been obvious to one of ordinary skill in the art to have combined the cited references because such statistical data usage would enable Davis to spread out route prefixes evenly and thus reduce the overall number of hash collisions [See Yu section 5.2.2, Para 3, Section 9 Para 2-3].

Conclusion

9. The prior arts made of record and not relied upon are considered pertinent to applicant's disclosure. See the accompanying PTO-892 form.

Contact information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Emeka Ebirim whose telephone number is 571-272-3994. The examiner can normally be reached on 8:30pm - 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hosain Alam, can be reached on 571-272-3978. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Emeka Ebirim
Examiner
Art Unit 2166

July 06, 2006

KHANH B. PHAM
PRIMARY EXAMINER